



Fort Detrick and National Interagency Confederation for Biological Research (NICBR)

# Walter Reed Army Institute of Research

**Dr. Marti Jett**





# USAMRMC Programs offering Scientific Training Opportunities

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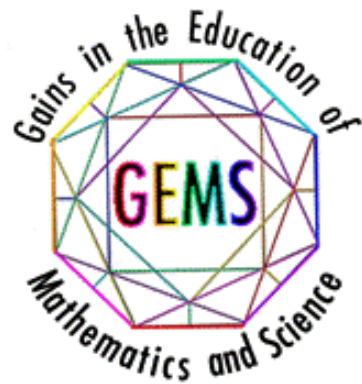
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**Walter Reed Army Institute of Research**





# Programs



- Gains in the Education of Math and Science (GEMS). 8-12<sup>th</sup> grade students. Provides opportunities for lab sciences to any interested student. Established in 1994



- Science and Engineering Apprenticeship Program (SEAP). 11-12<sup>th</sup> grades for well-qualified students. Established 1980



- College Qualified Leaders (CQL). Provides trained laboratory workers for DoD labs and offers them additional work experience, scholarship and educational opportunities





# Science and Engineering Apprentice Program (SEAP)

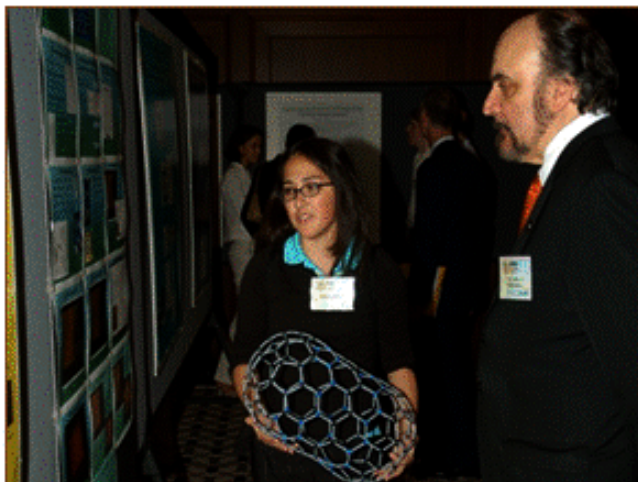
**Initiated in 1980 by Dr. Lin Krupsaw (Electrical Engineer)  
She persuaded DoD to accept summer high school interns**

- Eight week summer internship allowed advanced high school students to work with experienced DoD scientists in the laboratory
- Work as part of the DoD research team, applying efforts to ongoing research projects as an apprentice not just a teenager
- At end of summer, students are required to prepare 10 page final research report and present findings in a seminar format
- Students often contribute to research and become co-authors on scientific manuscripts



# SEAP – Benefits

- Encourage students to pursue science and engineering careers
- Provide students with opportunities in and exposure to scientific and engineering practice and personnel not available in their school environment
- Develop a student/citizen appreciation for the process and rigor of scientific research with a view towards potential govt service
- Prepare these students to serve as positive role models for their peers by encouraging other high school students to take more science and math courses

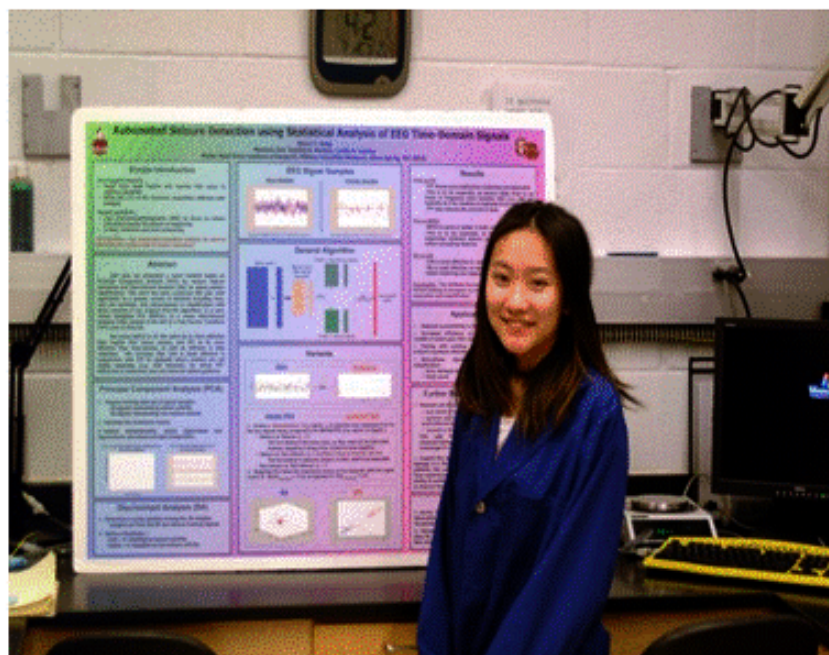




# SEAP Outcomes and Successes

- **Outcomes –**

- Students apply their skills to science fair projects and win scholarships that will enable them to pursue science careers.
- Intel Science Talent Search. Yearly, we have 1-2 semifinalists among 300 students selected from >10,000 nationwide
- 2005 had a finalist (one of 40 students nationwide). Called the “Junior Nobel Prize”.



## **Sherri Geng was Mentored by Dr. Lucille Lumley at WRAIR.**

The task was to establish algorithms to identify infrequent seizures from continual EEG monitoring of rats exposed to chem agents. Sherri taught herself Mathematical modeling/algorithm development using Mat Lab and produced a successful automated program





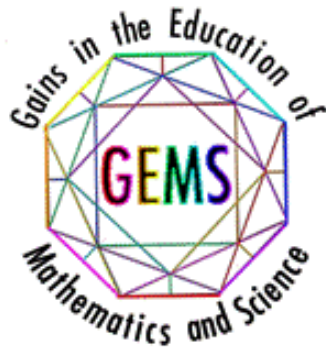
# Recognizing the need for GEMS

## **SEAP focused on the students who were mature and somewhat experienced**

- We observed that the 7-9<sup>th</sup> grade students were the ones eager to talk about science projects and showed incredible enthusiasm and awe about exploration
- If students were not pushing themselves to take high-level math by 7-8<sup>th</sup> grades, their opportunities for a career in STEM would be diminished.
- They needed opportunities and examples of scientific career possibilities.



# Gains in the Education of Mathematics and Science (GEMS)



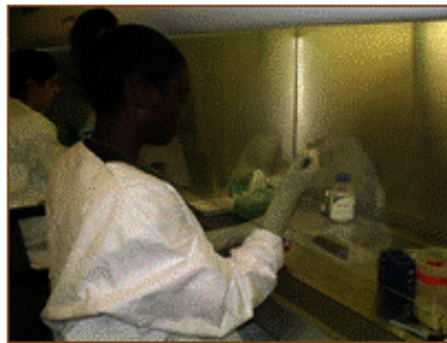
## GEMS Program Philosophy

- The GEMS program aims to identify science-enthusiastic youth, especially those who lack scientific opportunities to excel.
- The goal is to find them early enough to positively mold their fate and brighten their future with lifelong learning
- GEMS has been the spark to launch youngsters into scientific careers, and also has created a citizenry with positive attitude to science.





# Key elements of GEMS programs

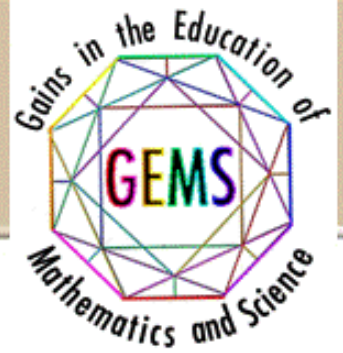


- Near-peer mentors (college students) lead young Jr/HS students as they carry out exciting experiments (in small groups, 4-6). They personify values in learning, talk about the need to take high level math and other courses. Learning is fun, relaxed and without criticism.
- Near-peer mentors are selected for their diverse backgrounds and strong ability to interact and teach. GEMS participants have become near-peer mentors themselves and are able to understand the younger students' experiences
- Successful GEMS students return year after year as they move from middle school to high school, and perform progressively more difficult experiments and grasp more complex concepts (GEMS-1, -2, -3)





# GEMS 1–3



- Three GEMS Levels for varying levels of previous science experience. Each builds on the previous years work
  - **GEMS 1:** A one intensive week carrying out simple biology, chemistry and physics experiments to increase interest in science and overall learning. The object is to cast a broad net and demonstrate that carrying out lab experiments is fun and rewarding. All are invited-stipend is \$50-100
  - **GEMS 2:** One to two week programs with more complex work, building on the techniques learned during GEMS 1. Work may include examination of neural toxicity, dissection of mosquito salivary glands, chromatography, etc
  - **GEMS 3:** A four week experience using complex state-of-the-art scientific tools and techniques, such as gene cloning. Students are required to complete a 5-page research report and poster to document their results
  - THOROUGHLY LEARN COMMON LAB TECHNIQUES, DECORUM, ETC





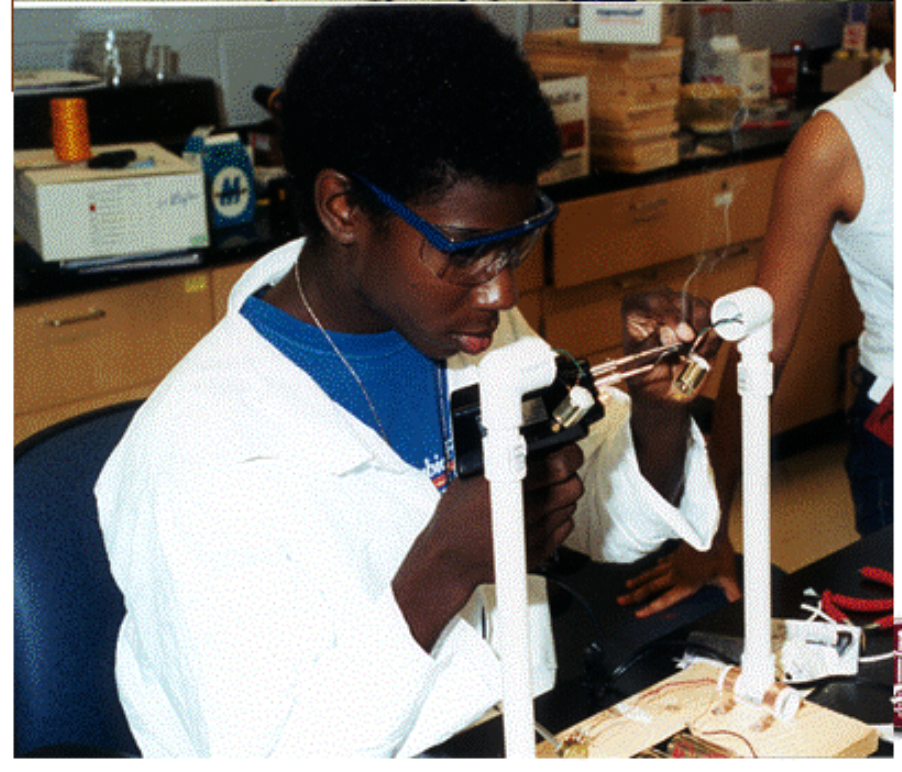
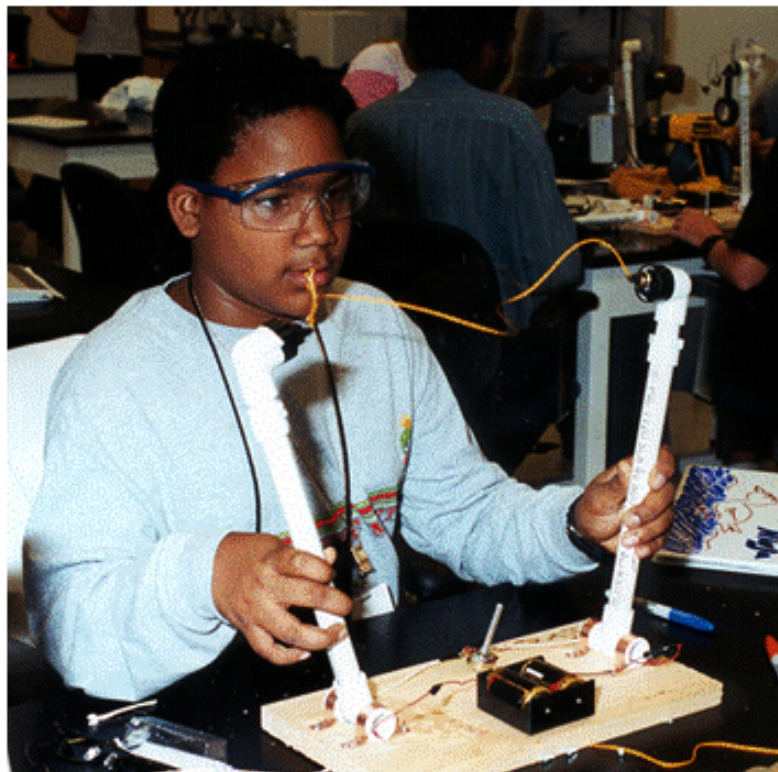
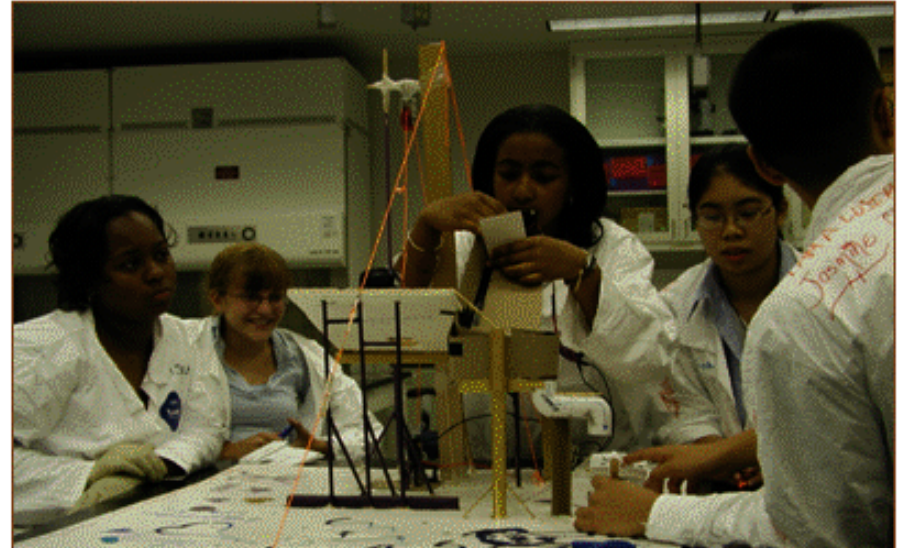
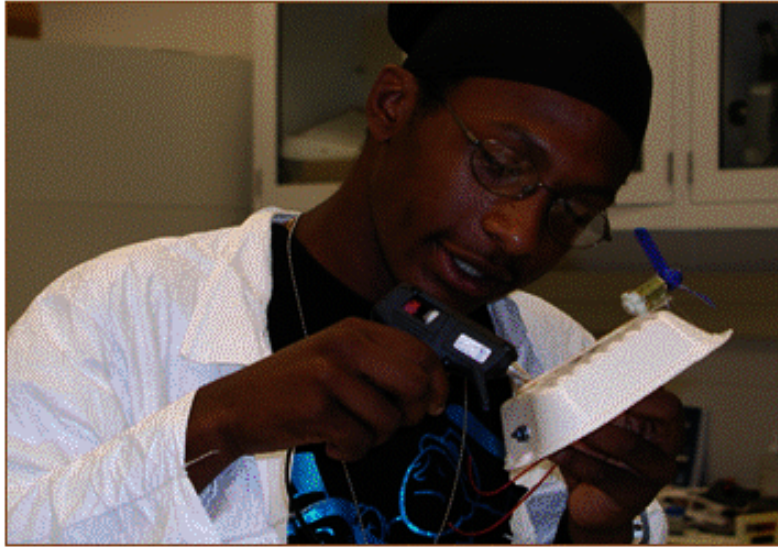


# GEMS 1 Module: *Analytical Chemistry*



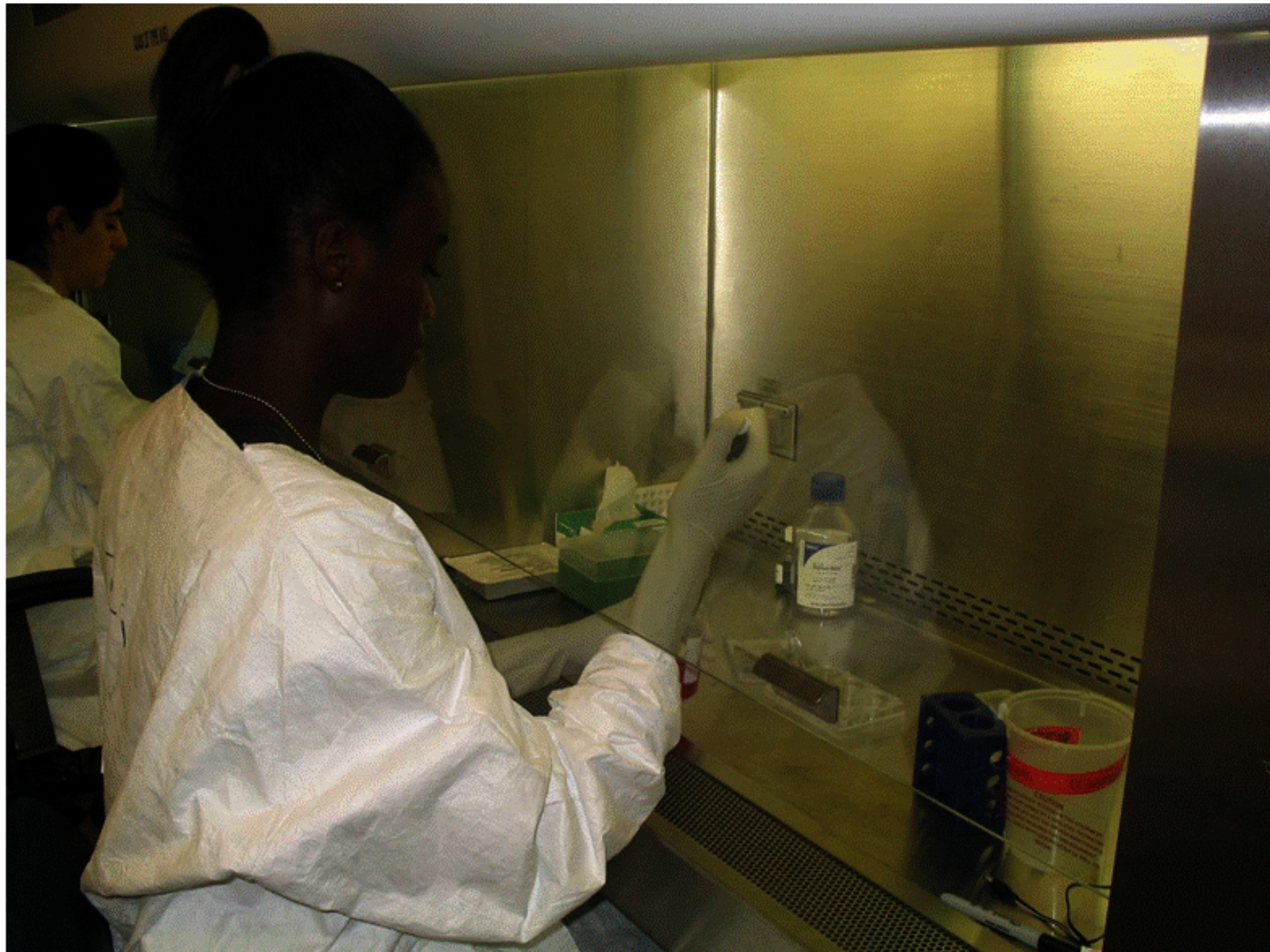


# Benefits include new skills, self-confidence





# **GEMS 2 Module: *Neurotoxicity and Breast Cancer Proliferation Studies in Culture***



**Rasha Hammamieh, Margery Anderson, Katharine Carr,  
Christine N. Tran, Debra L. Yourick, and Marti Jett (2005).**

*Students Investigating the Antiproliferative Effects of Synthesized Drugs on Mouse  
Mammary Tumor Cells.* Cell Biol. Education 4:221-235

Thank you so much for sending me the good news about the publication of our article. I am so happy and proud to see it in print!

I hope that all goes well with you this year, especially with the GEMS and SEAP programs. As for me, I'm in the second, very hectic week of classes. So, I've been busy getting to all 6 of my classes (most of them **chemical engineering** courses) and keeping up with my extracurriculars. I'd just like to let you know that the summer working with the GEMS students has really motivated me to keep up with that sort of work. **This year, I'll be in charge of organizing high school outreach events for the Ithaca youth to get them more involved in science and engineering fields.** I'll definitely be keeping GEMS in mind when thinking up creative ways to accomplish this goal!

If you have time to, please let me know how you're doing. I'll always love to hear from you. For now, I wish you all the best at WRAIR.

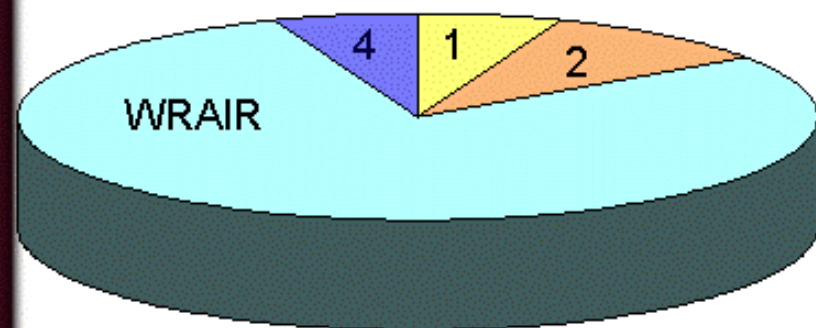
Regards, Christine



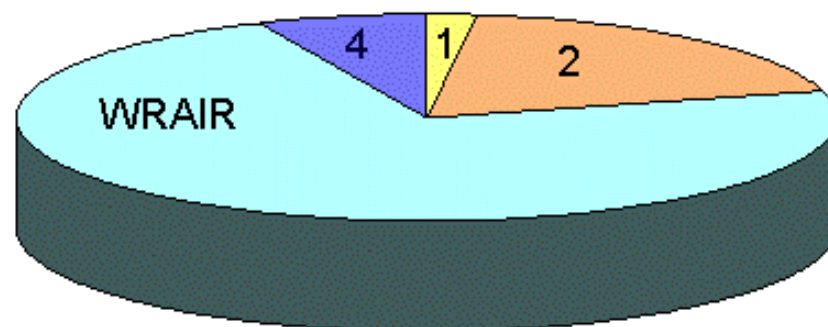


# Where did you learn to do the following?

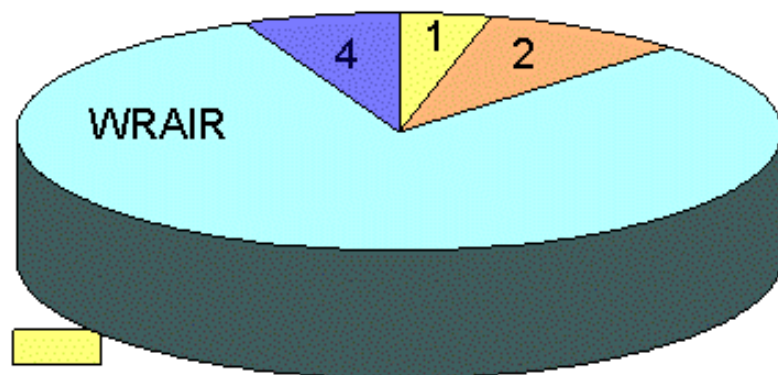
## Aseptic Technique



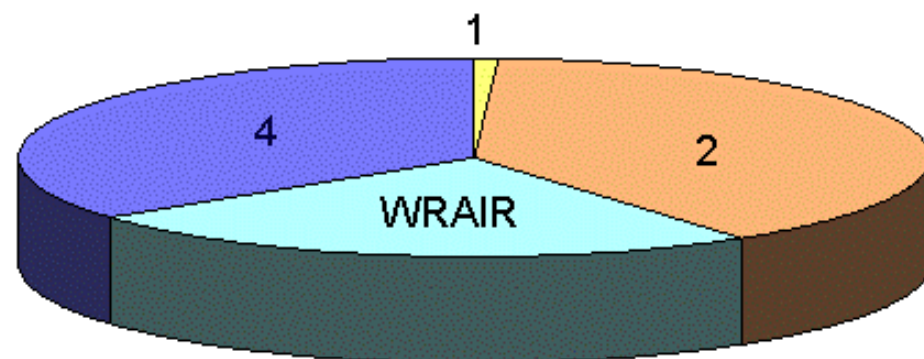
## Pipetting



## Growing Cells



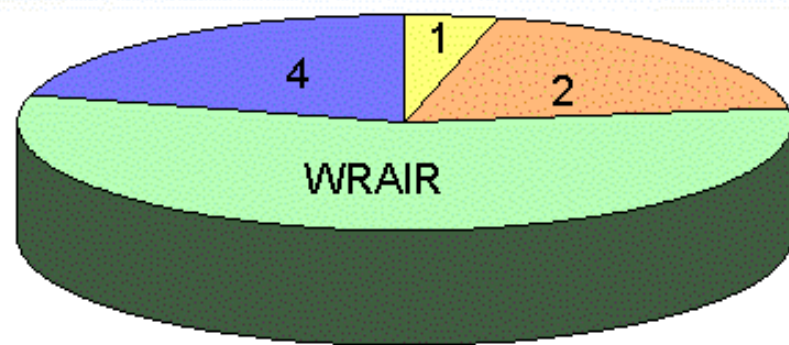
## Lab Safety



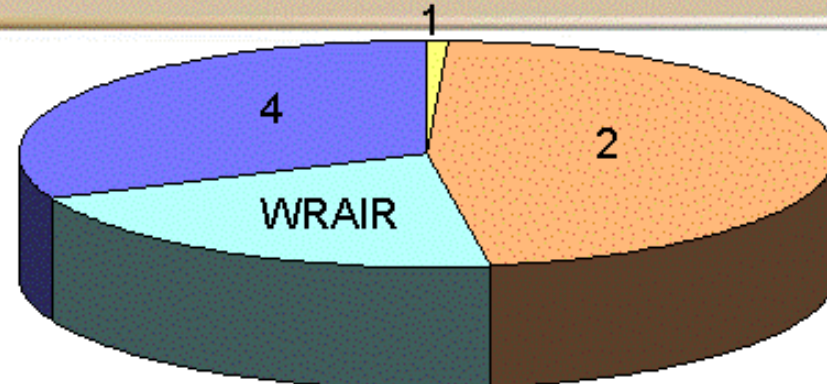
- 1=Neither
- 2=School
- 3=WRAIR
- 4=School and WRAIR




### Chemistry

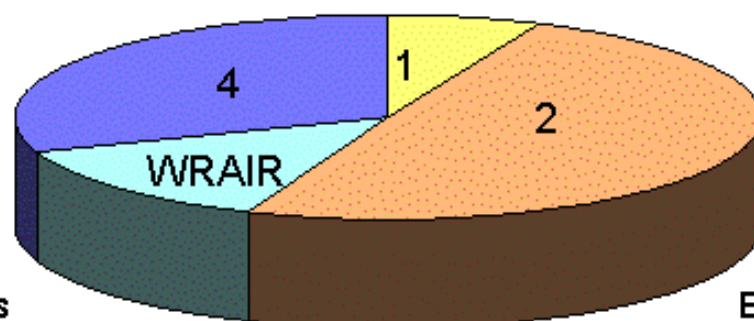


### Data Collection and Lab Notes

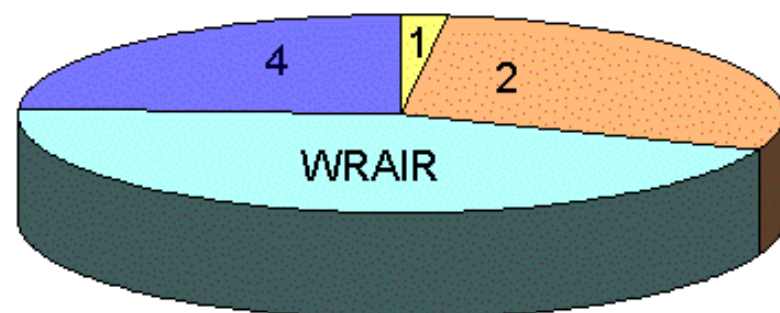


- 1=Neither 
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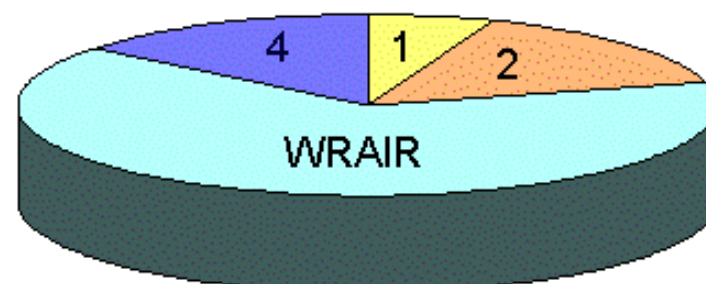
### Mathematics in Science



### Experimental Ideas



### Engineering





# GEMS 3 Module: *High-throughput Gene Cloning*







# Outcomes and Successes

## One Example of Success – Marquita

- Awarded an internship at WRAIR as a rising 8th grade, continued 6 years
- Her school had only 24% of students achieve proficiency in Math & English
- She said, “Near Peer Mentors were key to her keeping focused”
- Made Dean’s list yearly at Spellman College, Math Major, Biochem Minor
- Now a first year medical student at U. Pittsburgh

Yrs 1-2

Yr #3

Yr #4

Yr #5

Yr #6

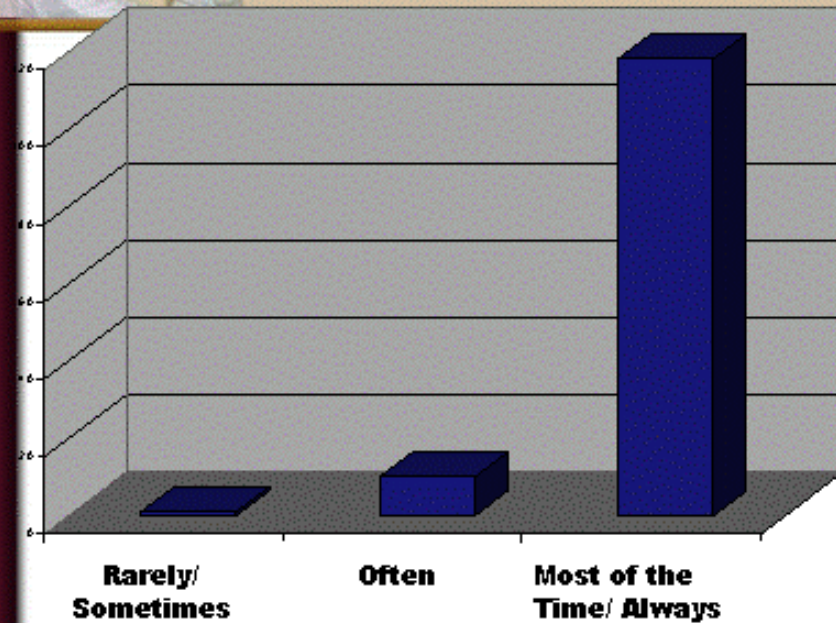
GEMS 1	GEMS 2	GEMS 3	High School (SEAP)		College Students	
8th-12th	10th-12th	11th-12th	11-12 <sup>th</sup>	12 <sup>th</sup>	Undergrad	Graduate
1 week program	2 week program	4 week program	8 week program	Mentorship	Research assistant	Mission research
Introduction to skills	5 day investigation	Experimental design	Apprentice and leader	Advanced project	Independent Investigation	
Guided by Undergrads. and Graduates			Guided by Undergrads. and Graduates		Guided by Grads	Guided by Scientist



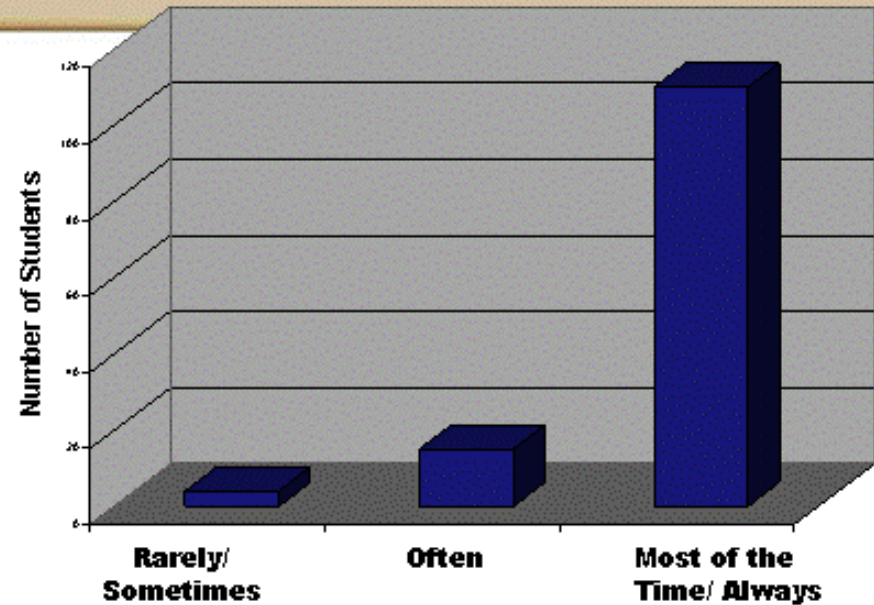
# At GEMS I Enjoyed

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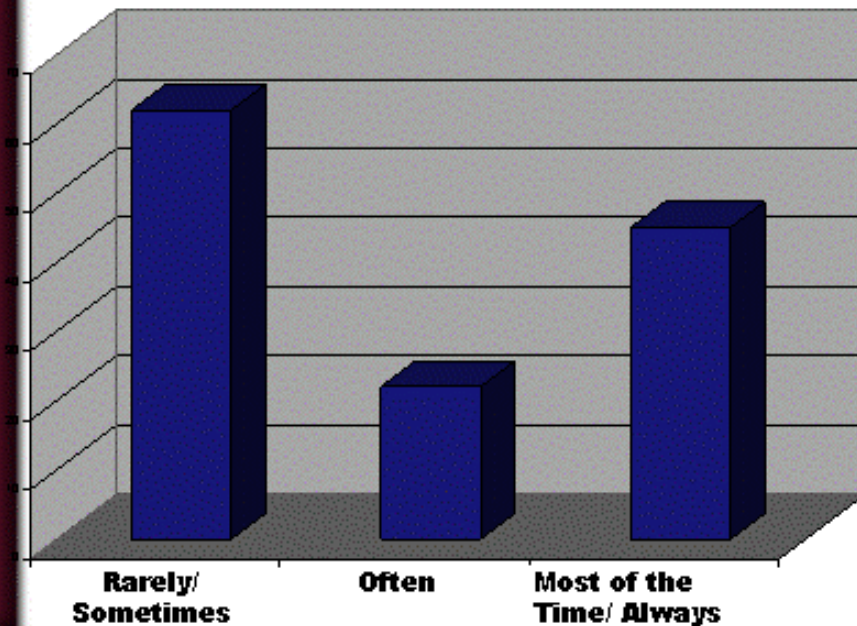
## Doing the Experiments



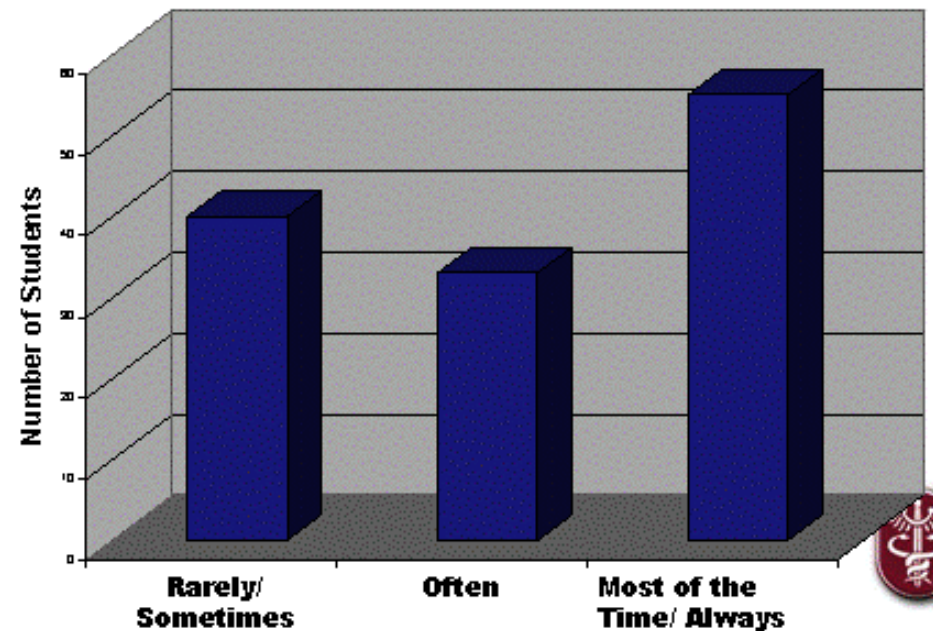
## Working on labs with other students



## Listening to Lectures



## Learning about what classes to take in school

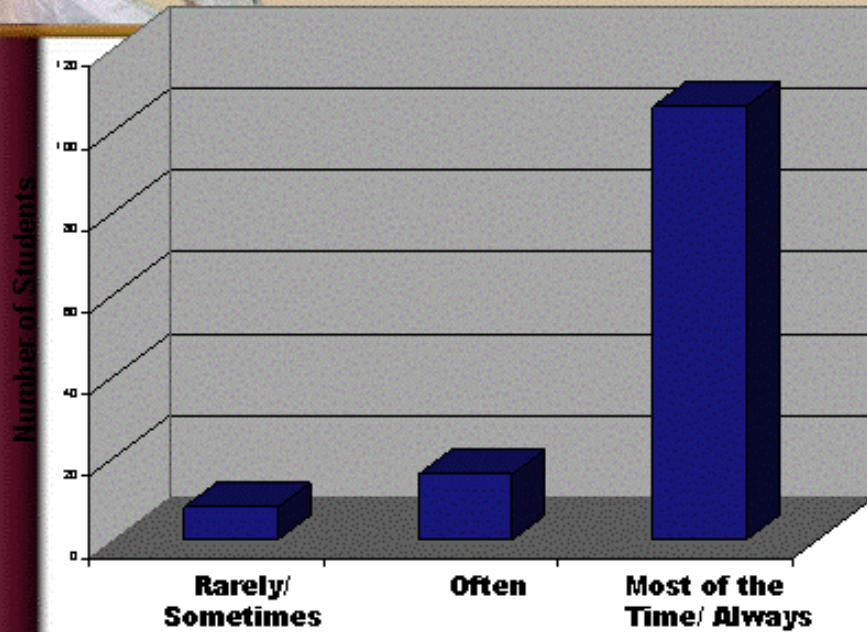




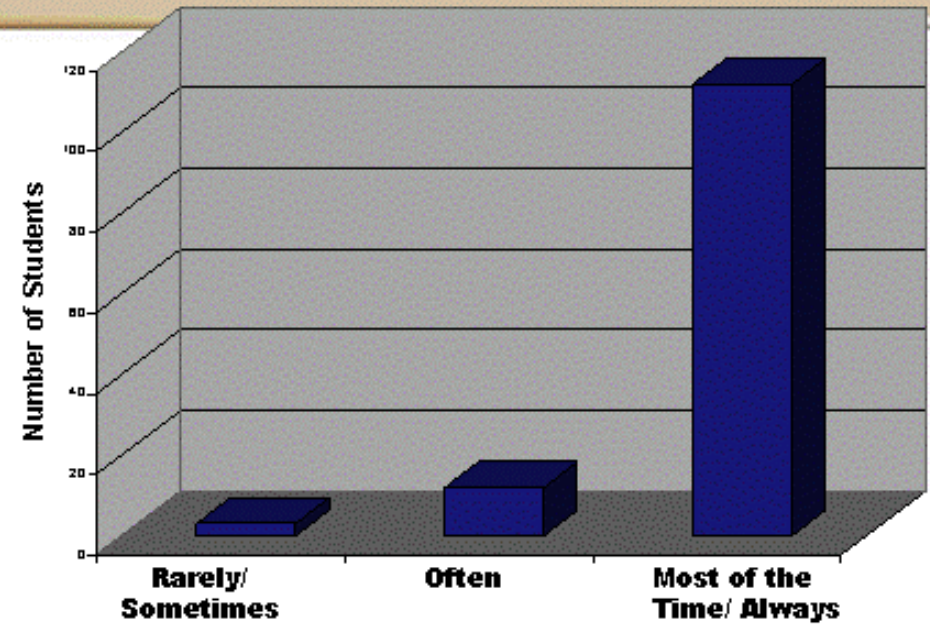
# My College Leader (near-peer mentors)

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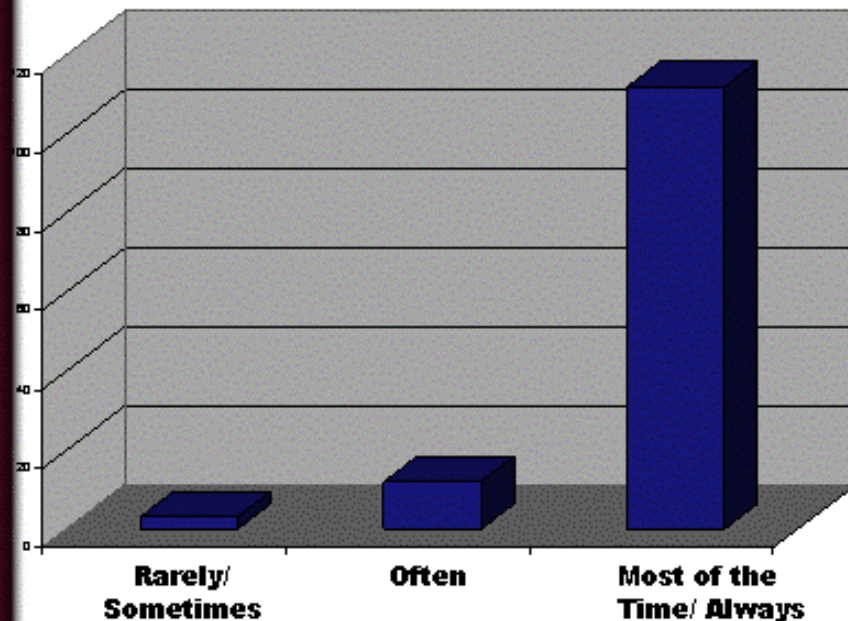
Really enjoyed teaching science



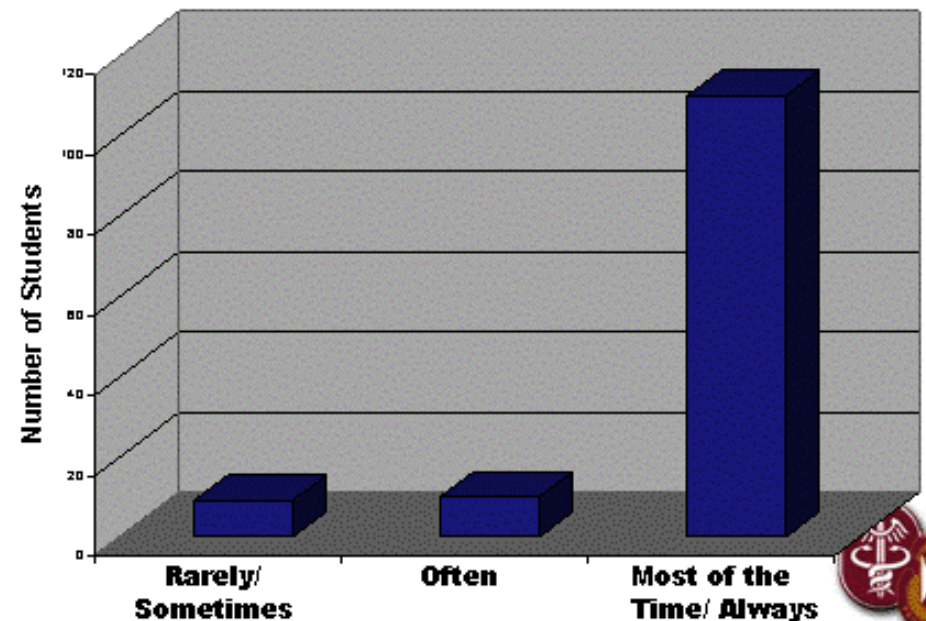
Expected me to do my best at all times



Gave me extra help when I did not understand



Encouraged me to think about a career in science

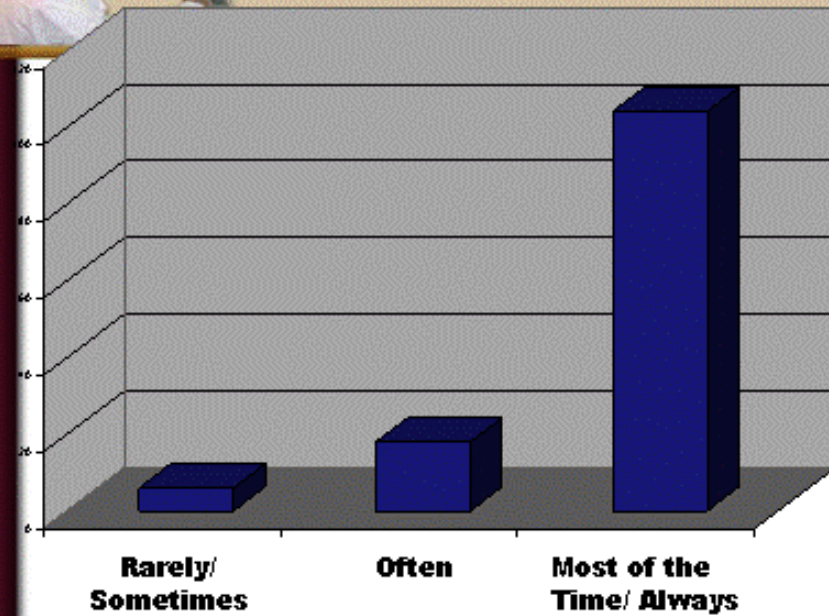




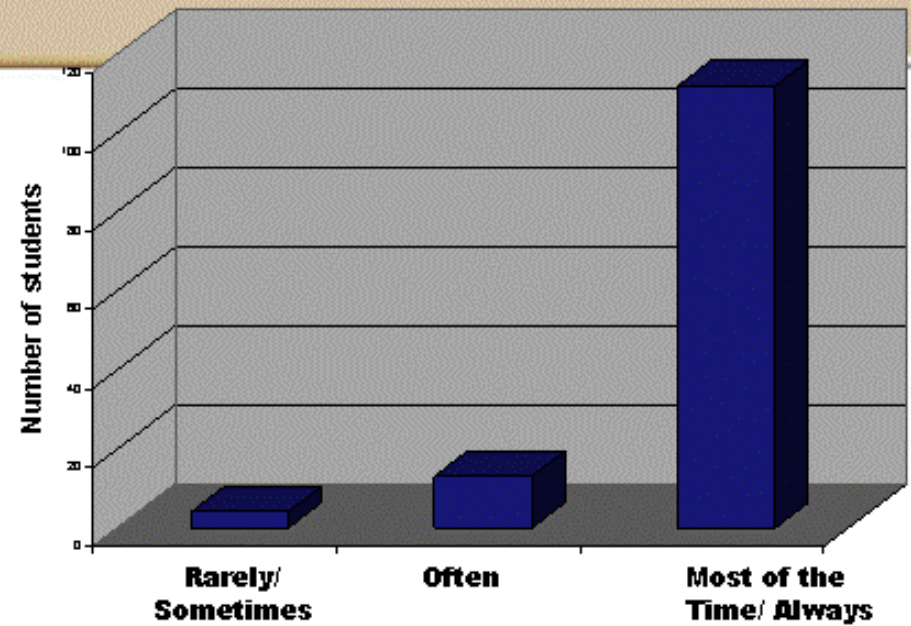
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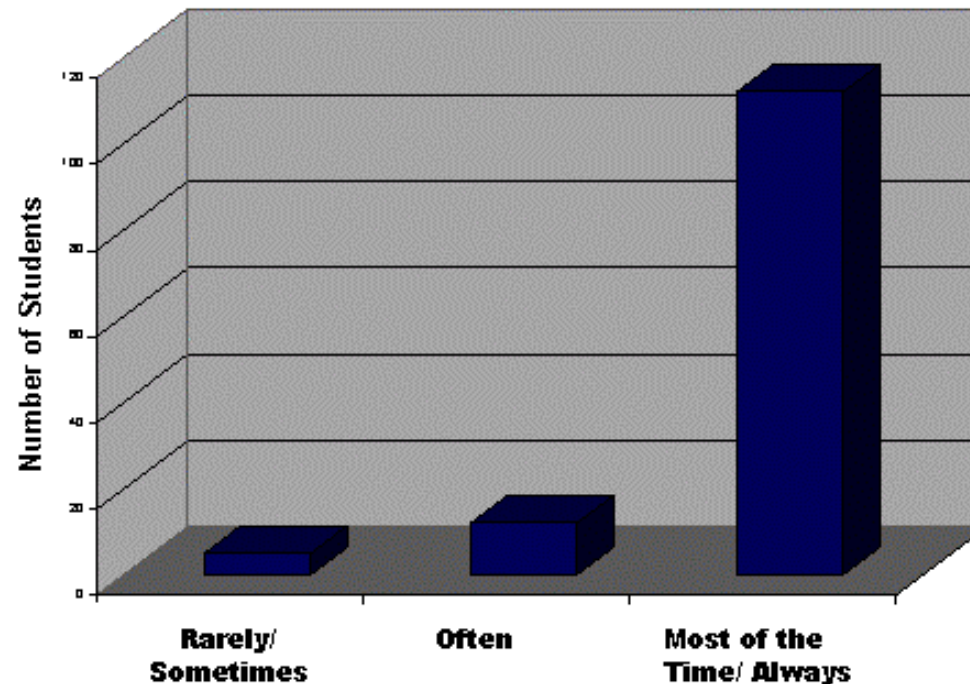
Were role models



Made science exciting



Respected my opinions and ideas





# Near-peer mentors say:

“The biggest positive to me was exposing the kids to what was going on in the labs upstairs...It was great to expose the kids to some of those, you know, truly innovative stuff that’s going on at VRAIR.”

“...they (mentors) trusted me to get things done and to get them done in a timely manner.”

“I guess it even exceeded {my expectations}, working in an actual lab where real research was actually going on. I guess it just kind of almost blew my mind. I was just amazed.”

“It made me more assertive in situations and ...more a leader and it definitely boosted my confidence.”

“...gave me an appreciation for a variety of different people. I was surprised at how people could, you know, different backgrounds and even of different countries and speak different languages could just come together and work so well with each other, and actually make progress on projects and research.”

“...just the people I work with, the whole positive attitude, the positive environment, just makes you want to do work and just putting all your effort into it.”







## Comment from a Near-Peer Mentor, 2006

“Rewarding in the sense that I finally found myself working at a place that made a difference.”





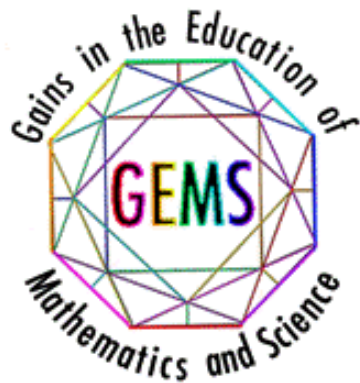
# GEMS is readily disseminated

- Each additional site introduces new excitement, clever experimental studies and scientists eager to participate
  - USAMRIID (Summer 2006) Dr. Beth Leffel
  - George Washington University (3 years)
  - ARL-Adelphi and APG-Aberdeen Proving Ground (2 years)
  - Redstone Arsenal (Huntsville, AL)
  - Salish Kootenai College on Flathead Indian Reservation
- Sites are diverse and include Universities, research labs, public schools





# Funding these Educational Programs



- GEMS has been supported by NIH as an innovative experiment in teaching science and is a race / gender equity program.  
*Science Education Partnership Award*  
*Grant no. 5R25RR018619-03 (6 years)*



- SEAP administration is funded by the Army at George Washington University, but stipends are provided by individual labs



- CQLs are supported entirely by individual laboratories utilizing their own RDTE funds



# College Qualified Leaders (CQL) – Goals and Objectives



- Afford professional scientists the opportunity to have fully trained students return to their laboratory during their college years
- Give mentors the opportunity to share their passion for science with talented undergraduates
- Give college students, both graduate and undergraduate, the opportunity to continue their research and training in a single laboratory
- Educate undergraduates and graduates about the research process by performing actual research
- Students have the opportunity to work in the same laboratory throughout the year, not just for a few weeks in summer





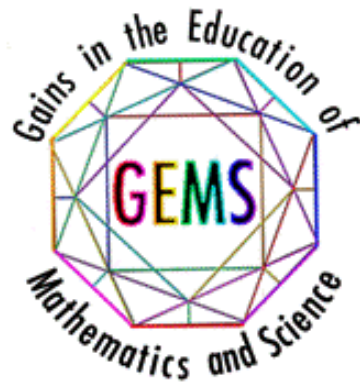
# CQL – Benefits



- Prepare a new generation of scientists and mentors
- Provide a learning community for the developing professional in DoD laboratories
- Many students are included on full publications and make presentations at national scientific meetings
- Used by several USAMRMC laboratories and is expanding
- Transition to contract or fellowship status with attainment of Ph.D. (or M.D.) is possible
- CQLs have also been made civilian employees depending upon availability of slots and long-term funding



# Program growth



- **GEMS and CQL near peer mentors:**  
Infinitely expandable



- **SEAP and CQL:** Unique to research laboratory settings and highly dependent on funding of research programs.

